

Artificial Intelligence

Course Title: Artificial Intelligence
Course No: BIT252
Nature of the Course: Theory + Lab
Semester: IV

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:

The course introduces the concepts artificial intelligent. It includes the basics of artificial intelligence, intelligent agents, problem solving, searching, knowledge representation systems, probabilistic reasoning, neural networks, machine learning and natural language processing.

Course Objectives:

The main objective of the course is to introduce fundamental concepts of artificial intelligence and to learn intelligent agents, identify AI problems and solve the problems using searching, design knowledge representation and expert systems, understand concepts of machine learning and natural language processing.

Course Contents:

Unit I: Introduction (3 Hrs.)

Artificial Intelligence (AI), History of AI, AI Perspectives, Turing Test, Foundations of AI, Scope of Symbolic AI, Applications of AI

Unit II: Agents (5Hrs.)

Introduction of Agents; Configuration of Agents: PEAS description of Agents; Types of Agents: Simple Reflexive, Model Based, Goal Based, Utility Based, Learning Agent; Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent

Unit III: Problem Solving by Searching (10 Hrs.)

Problem Solving; State Space Representation; Problem Formulation; Constraint Satisfaction Problems

Solving Problems by Searching; Performance evaluation of search techniques; Uninformed Search: Depth First Search, Breadth First Search, Depth Limited Search, Iterative Deepening Search, Bidirectional Search;

Informed Search: Greedy Best first search, A* search, Hill Climbing;

Game playing: Adversarial search techniques, Mini-max Search, Alpha-Beta Pruning

Problem Decomposition: Goal Trees, AO*

Unit IV: Knowledge Representation (14 Hrs.)

Knowledge; Knowledge Representation; Issues in Knowledge Representation, Knowledge Representation Systems; Properties of Knowledge Representation Systems

Logic Based: Propositional and Predicate; Propositional Logic: Syntax, Semantics; CNF Form; Inference using Resolution; Backward Chaining and Forward Chaining; Predicate Logic: FOPL: Syntax, Semantics; Quantification; Inference with FOPL: Unification and Lifting; Inference using Resolution

Semantic Nets, Frames, Rule Based Systems, Scripts, Conceptual Dependency

Statistical Reasoning: Uncertain Knowledge, Random Variables, Prior and Posterior Probability, Bayes' Rule, Bayesian Networks, Reasoning in Belief Networks, Dempster-Shafer Theory

Unit V: Neural Network (2 Hrs.)

Neural Networks: Introduction; Mathematical Model of ANN, Designing a neuron, Types of ANN: Feed-forward, Recurrent, Single Layered, Multi-Layered, Learning Rule, Learning Rate, Application of Artificial Neural Networks

Unit VI: Machine Learning (5 Hrs.)

Machine Learning; Concepts of Learning: Supervised, Unsupervised and Reinforcement Learning; Learning by Analogy; Learning by Genetic Algorithm; Learning by Back-propagation

Unit VII: Expert System (3 Hrs.)

Expert Systems; Architecture of Expert System; Development of Expert Systems; Applications of Expert Systems

Unit VIII: Natural Language Processing (3 Hrs.)

Natural Language Processing: Natural Language Understanding and Natural Language Generation

Steps in NLP: Lexical Analysis, Syntactic Analysis, Semantic Analysis, Discourse and Pragmatic Analysis; Ambiguities in NLP

Laboratory Works:

The laboratory work consists of implementation of intelligent agents and expert systems, searching techniques, knowledge representation systems and machine learning techniques. Students are advised to use LISP, PROLOG, or any other high level language.

Text Books:

1. Stuart Russel and Peter Norvig, *Artificial Intelligence A Modern Approach*, Pearson

Reference Books:

1. E. Rich, K. Knight, Shivashankar B. Nair, *Artificial Intelligence*, Tata McGraw Hill.
2. George F. Luger, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, Benjamin/Cummings Publication
3. D. W. Patterson, *Artificial Intelligence and Expert Systems*, Prentice Hall.
4. P. H. Winston, *Artificial Intelligence*, Addison Wesley.
5. Tutorials for LISP and PROLOG